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(71) Applicant : **ATLA COOP. Soc. Coop. a r.l.**
Via Bolognese n. 5
I-50037 San Piero a Sieve (Firenze) (IT)

(72) Inventor : **Bruno, Angelo**
Via Borgatti n.4
I-40141 Bologna (IT)

Inventor : **Conti, Giovanni**
Via D. Alighieri n.8
I-50041 Calenzano, Firenze (IT)
Inventor : **Parigi, Stefano**
Via del Saccardo n.28
I-50041 Calenzano, Firenze (IT)
Inventor : **Santini, Paolo**
Via dei Tigli n.8
I-50041 Calenzano, Firenze (IT)
Inventor : **Meucci, Sergio**
Piazza Ballerini n.11
I-50013 Campi Bisenzio, Firenze (IT)

(74) Representative : **Mannucci, Gianfranco, Dott.-Ing. et al**
Ufficio Tecnico Ing. A. Mannucci Via della Scala 4
I-50123 Firenze (IT)

(54) Method and equipment for the joining of sections converging at a corner of a metal frame, with gluing between the sections and the internal bracket.

(57) The liquid adhesive is injected between the bracket S and the sections P after the positioning of the components. The equipment comprises, in addition to the chamfering tools capable of causing the deformation of the external walls of the sections (P) to bear against stops of the bracket (S), devices for drilling (52, 52A) and devices (50, 50A) for injecting a liquid adhesive capable of securing the fastening between the bracket and the sections.

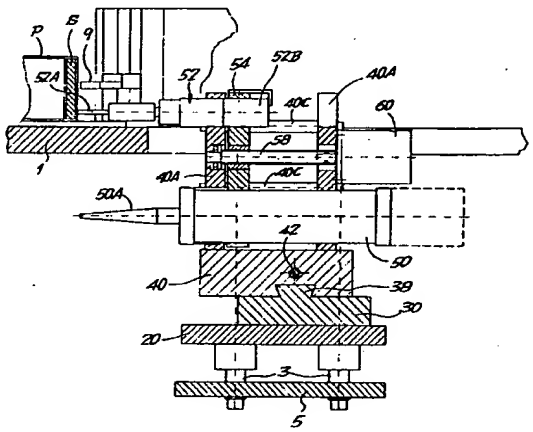

FIG.5

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FIG.1

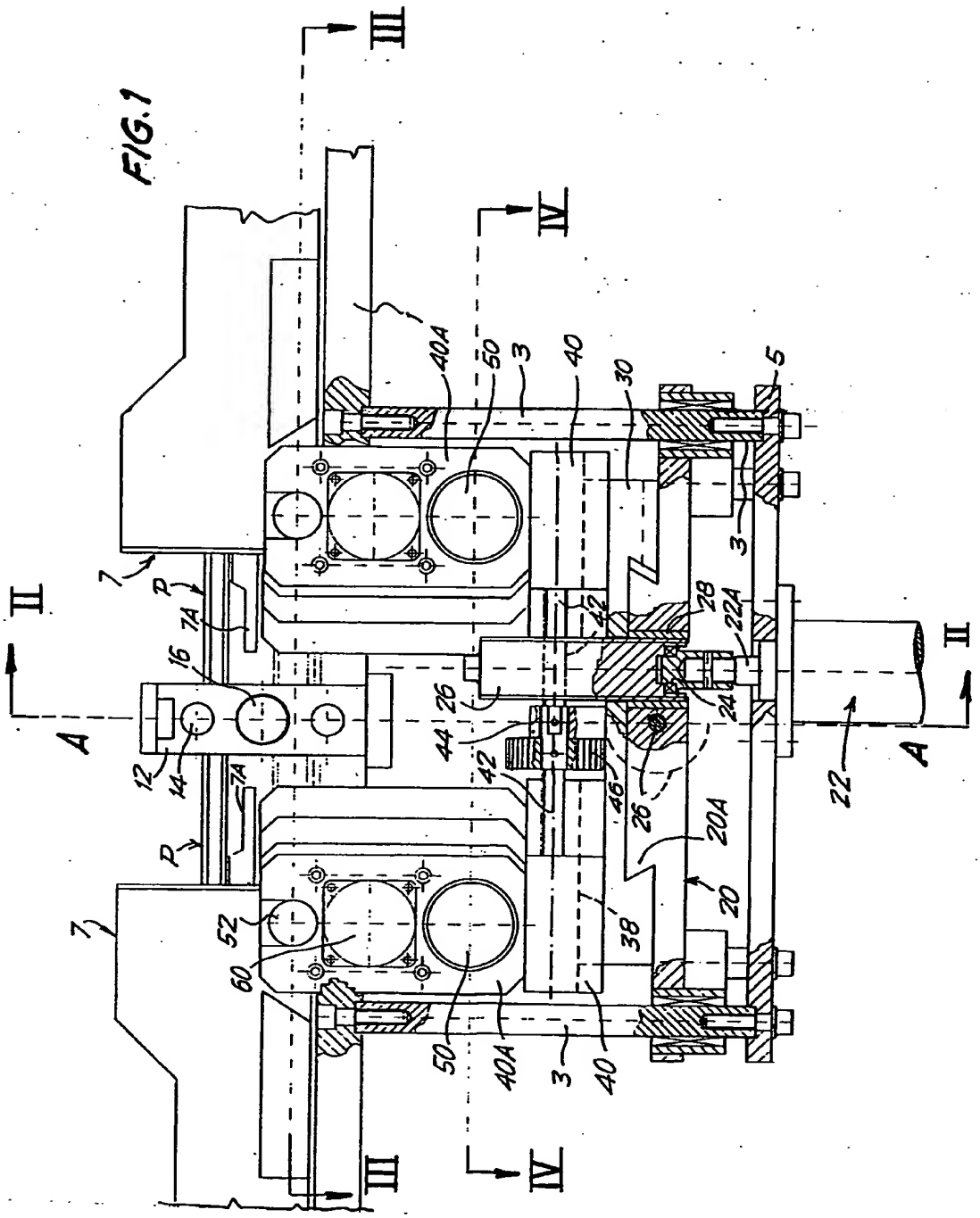

III
IV
II
A
7
P
7A
16
12
14
52
60
40A
50
3
40
30
5
28
22A
24
26
44
42
46
20A
20
38
22

FIG. 2

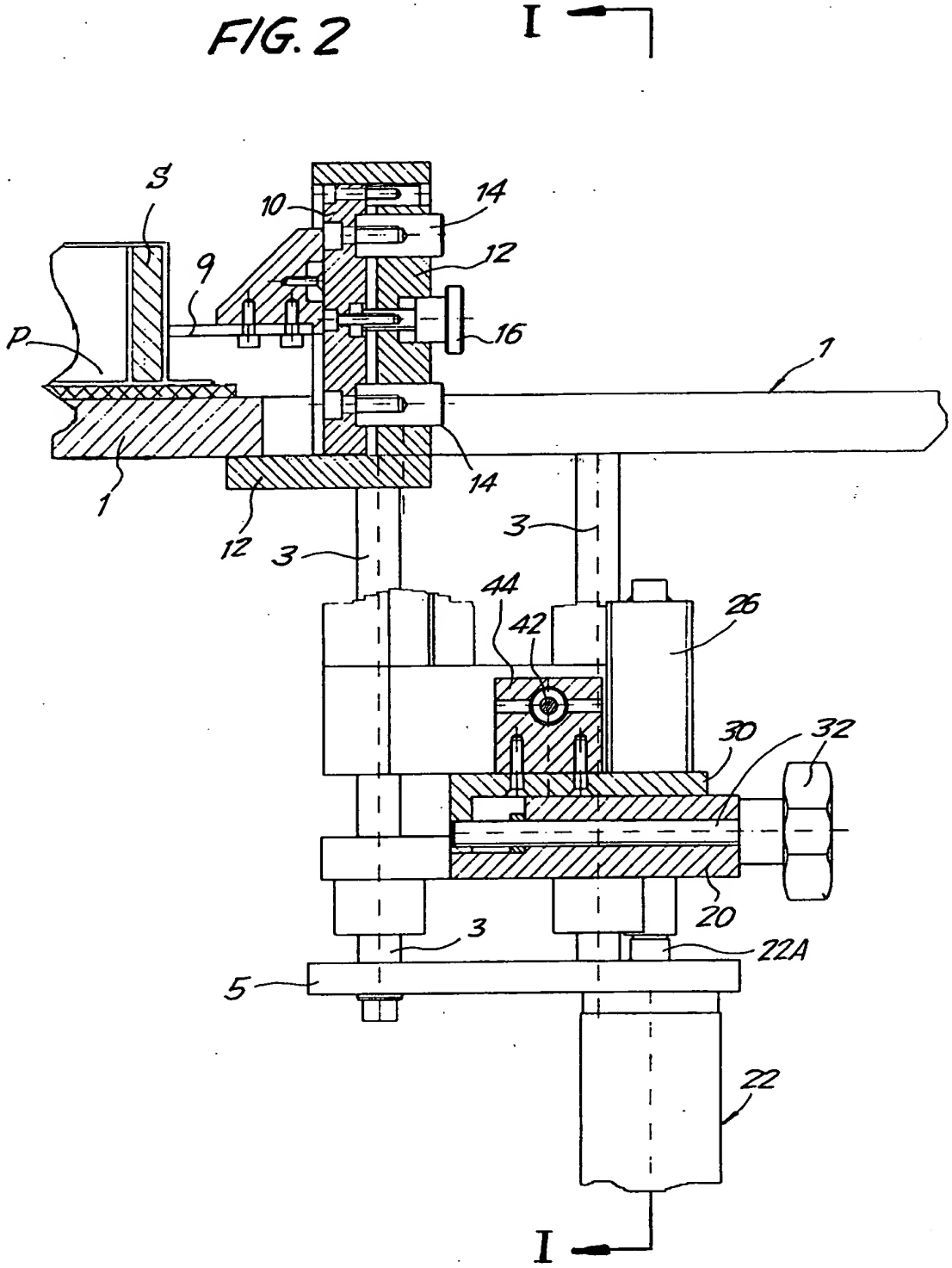


FIG.3

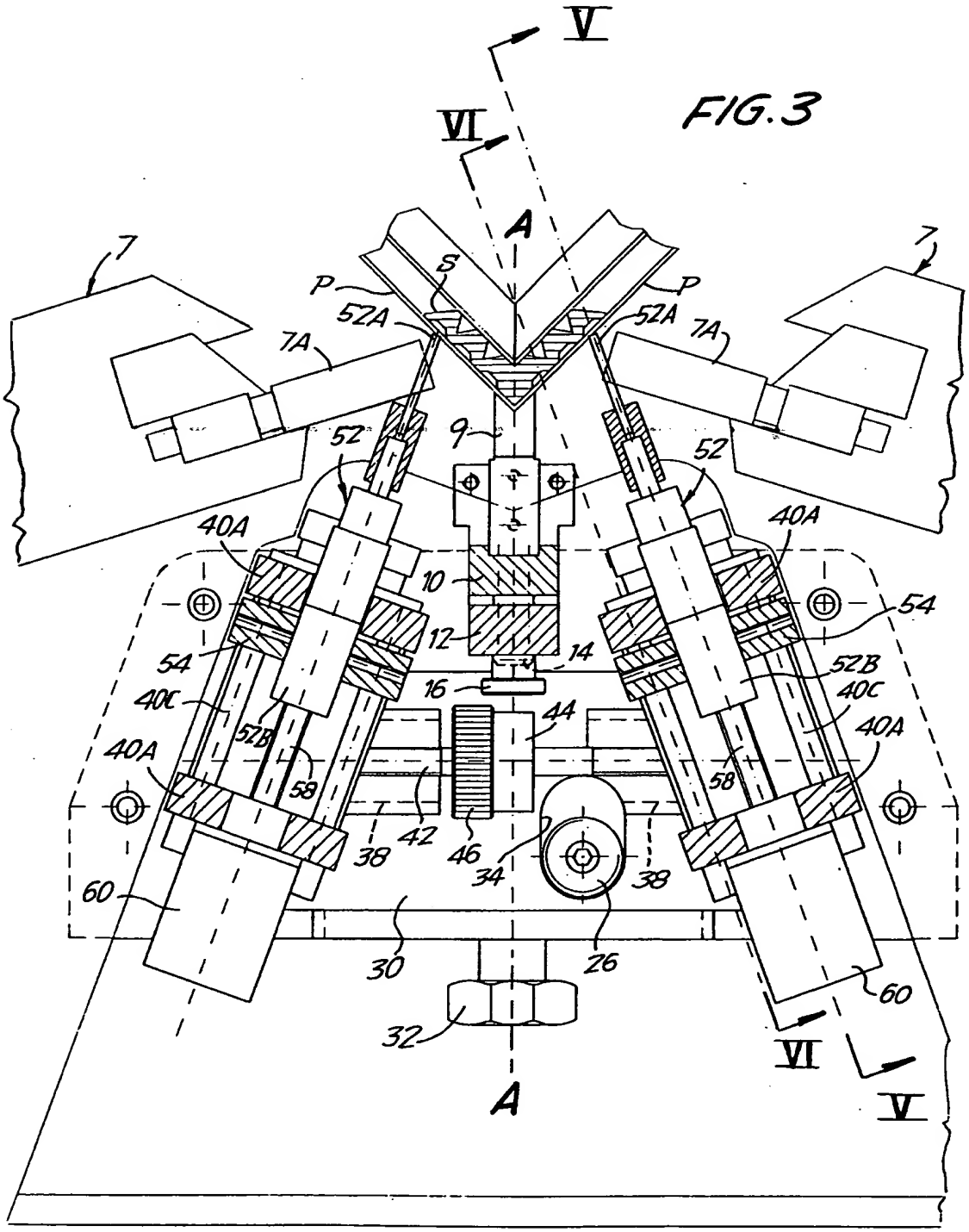
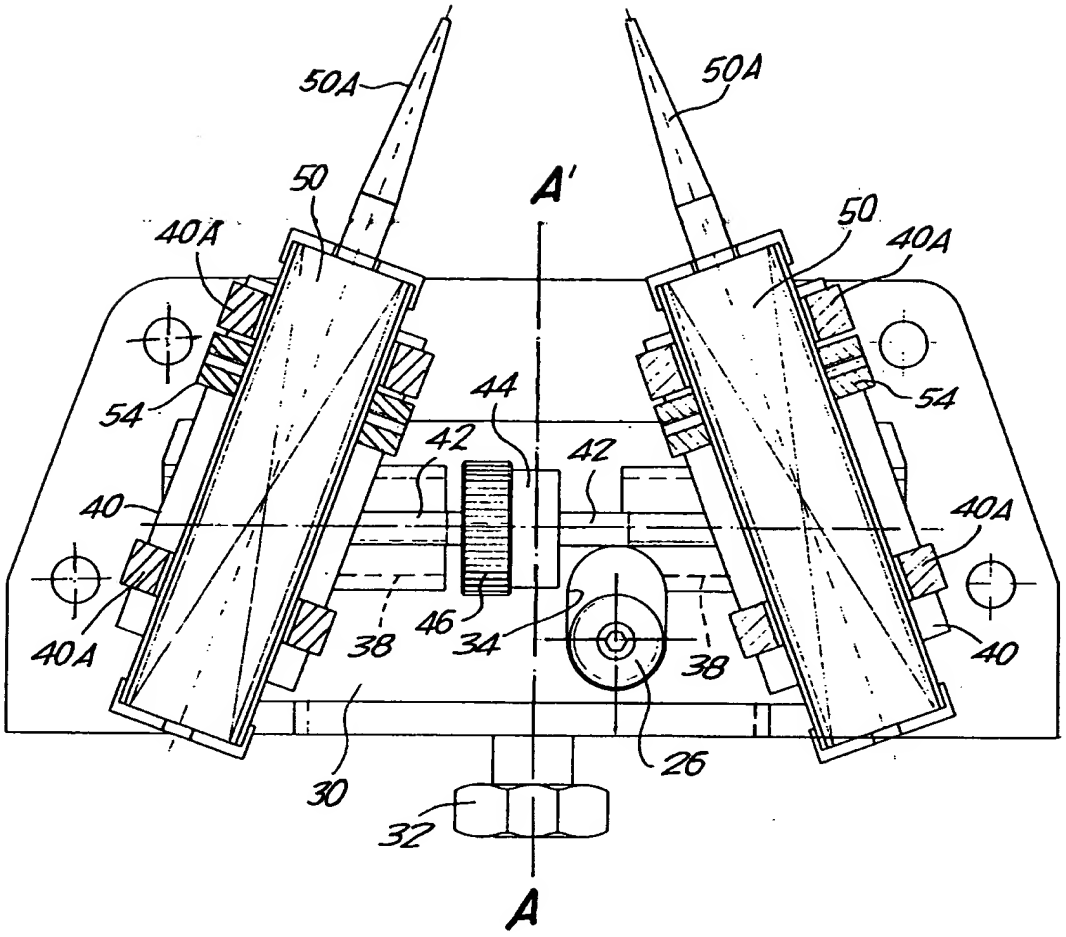

V
VI
A
7
P
S
52A
7A
52
9
40A
10
12
14
16
54
40C
52B
44
58
42
46
34
38
60
30
26
32

FIG. 4


50A
50A
50
A'
50
40A
40A
54
54
44
42
42
40
40A
40A
46
34
38
38
40
30
26
32
A

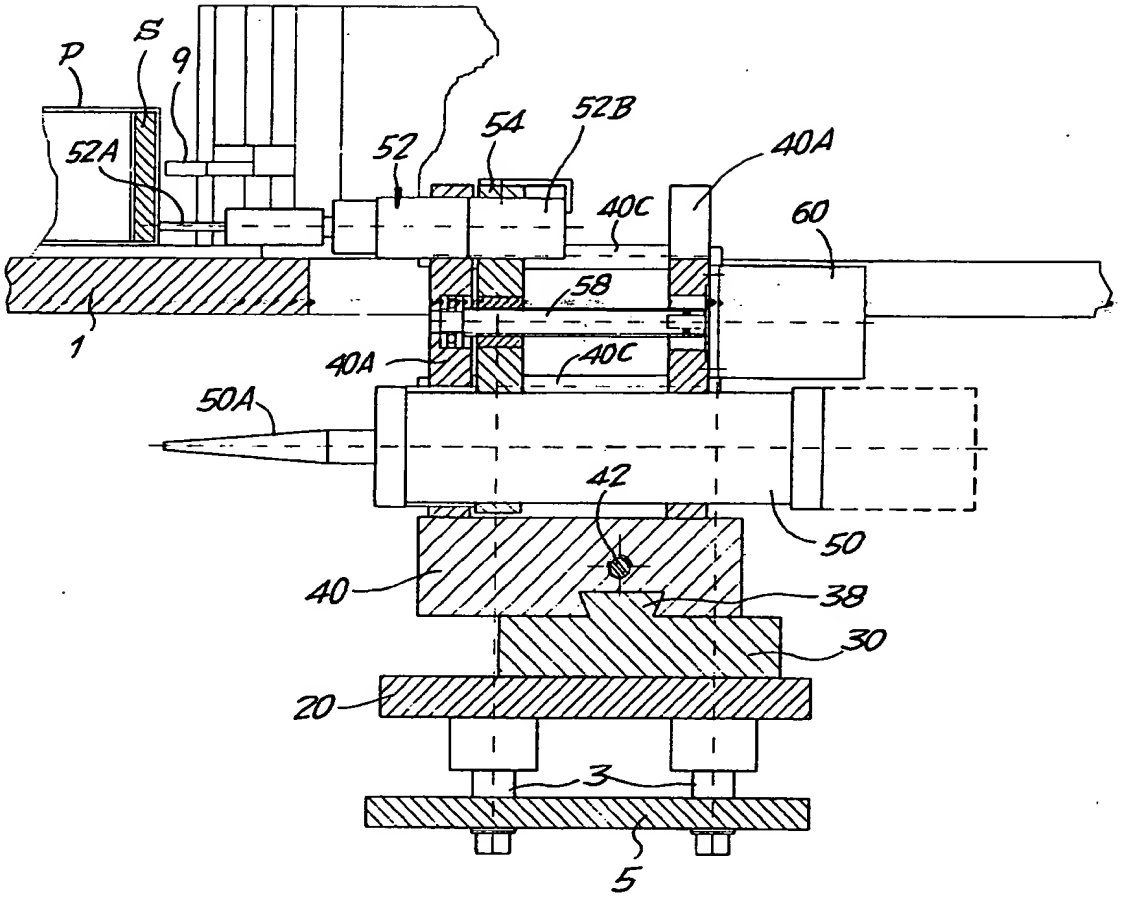


FIG.5

FIG. 6

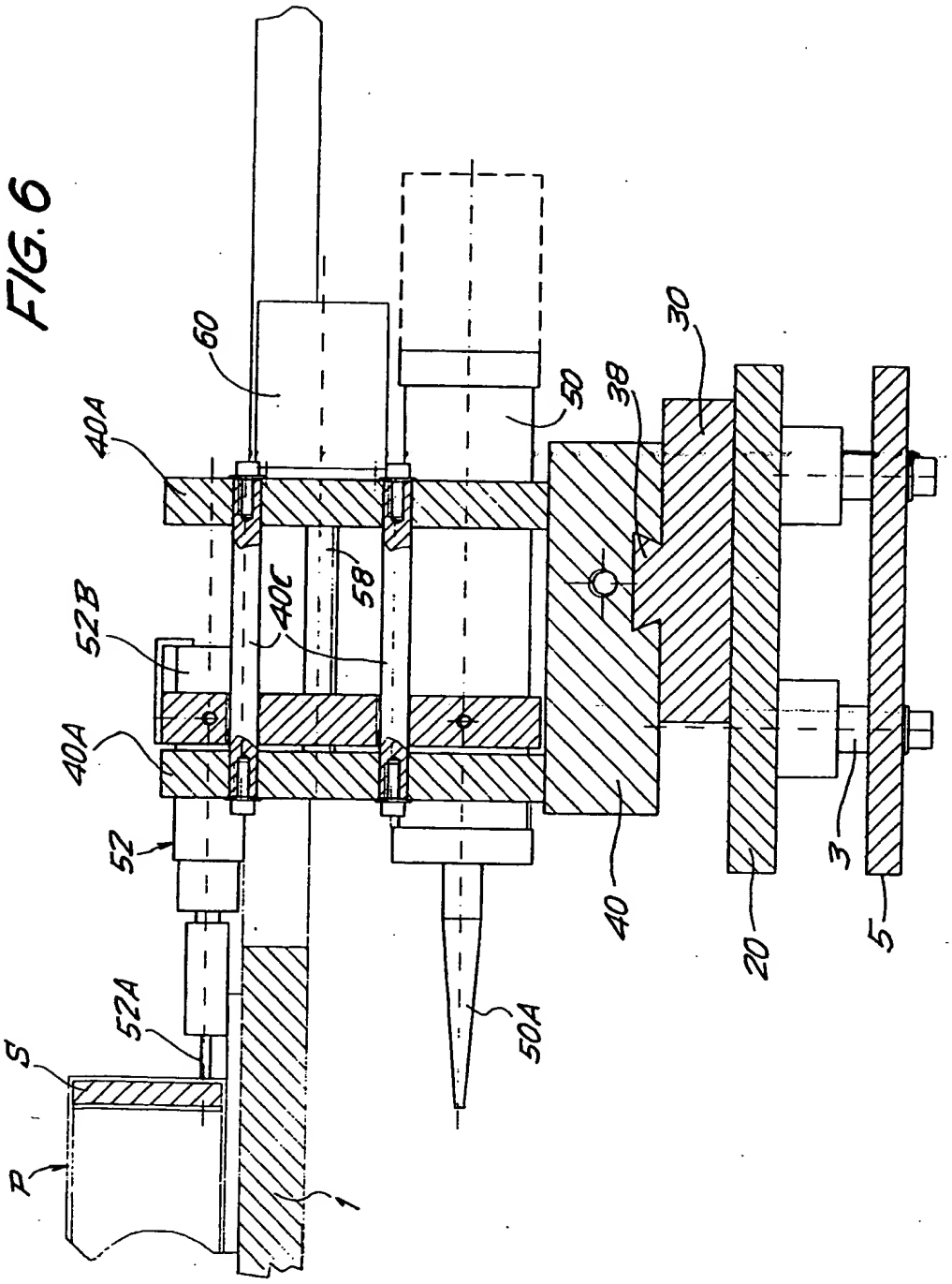
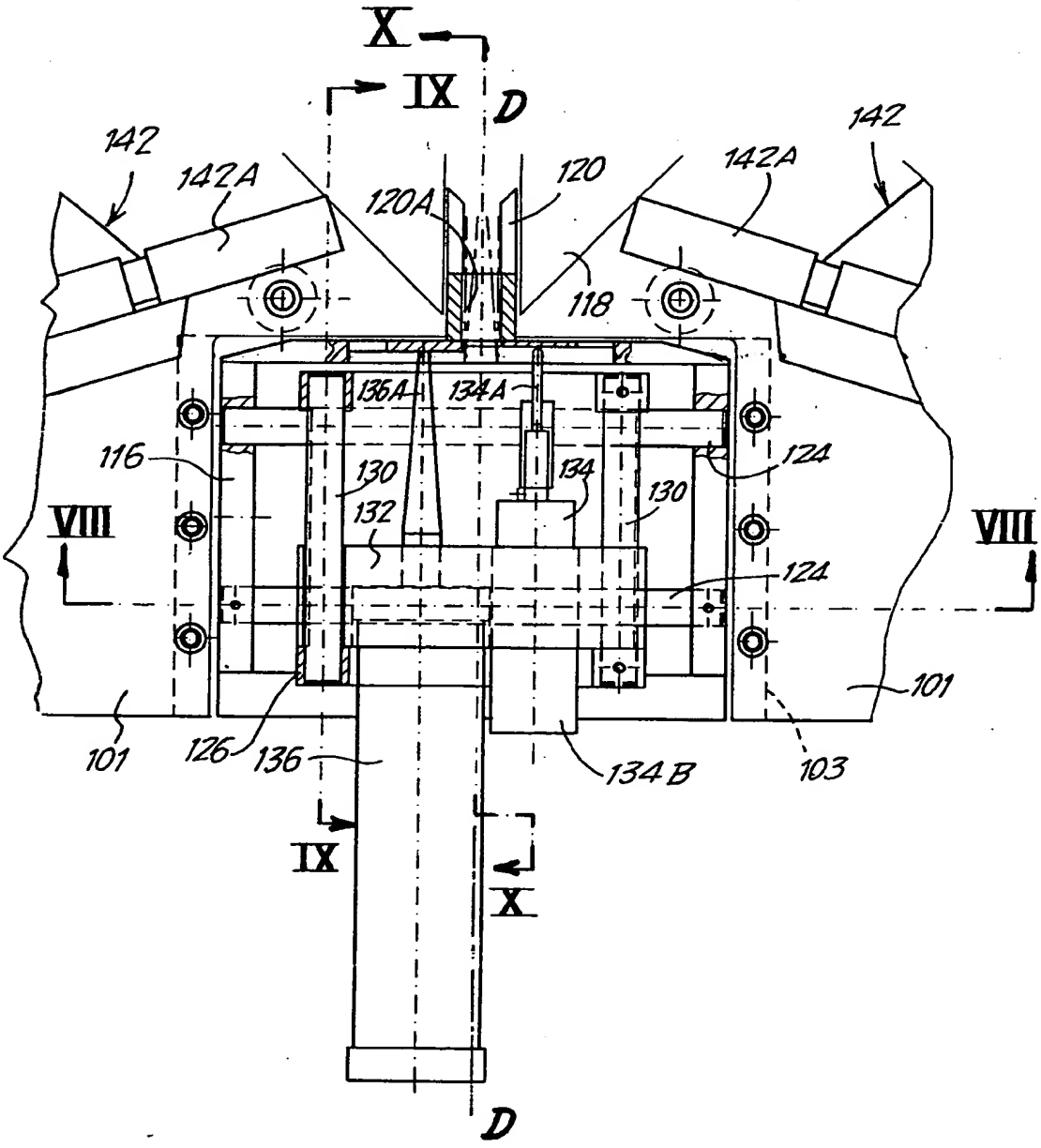


FIG.7


X
IX
D
142
142A
120A
120
118
142A
142
136A
134A
116
130
134
132
130
124
VIII
VIII
124
101
101
126
136
134B
103
IX
X
D

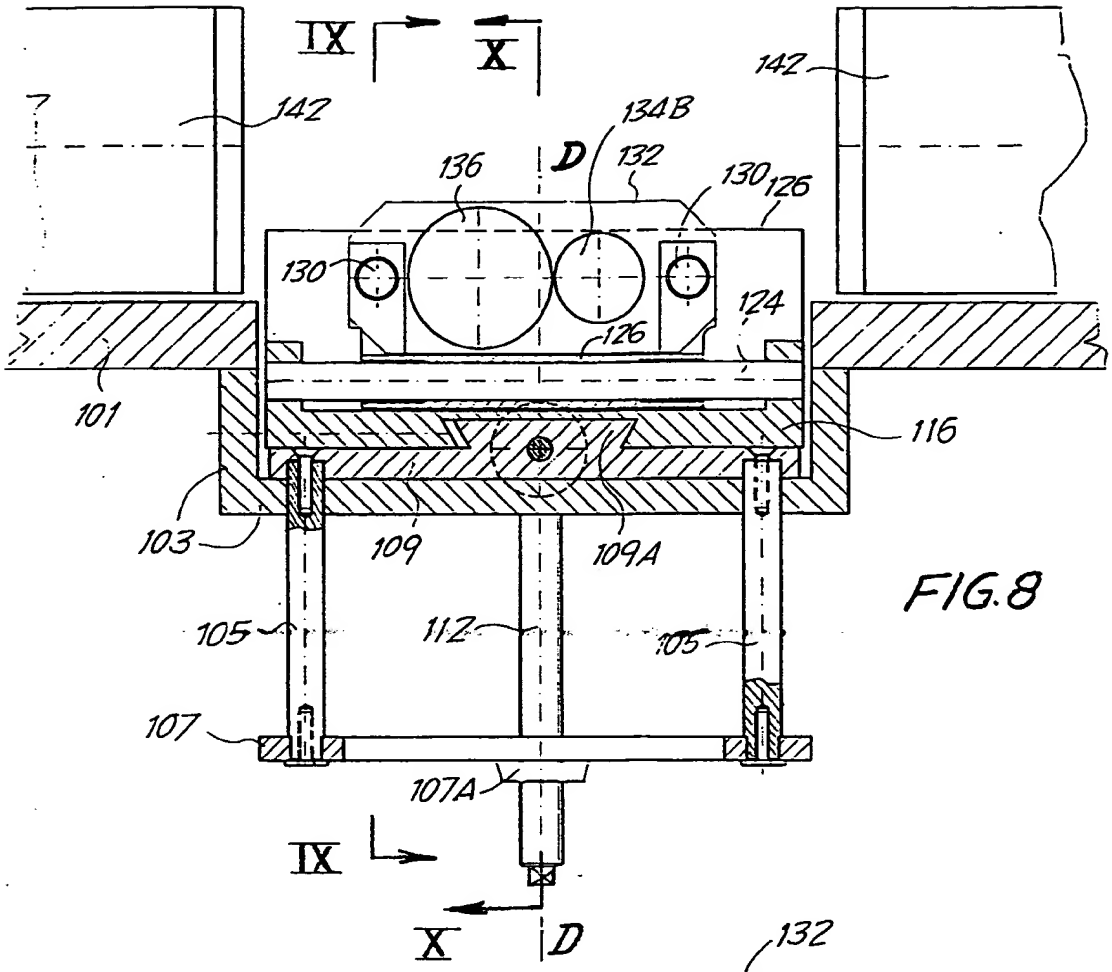

IX
X
142
142
134B
D
132
136
130
126
130
124
126
101
116
103
109
109A
105
112
105
107
107A
IX
X
D

FIG.8

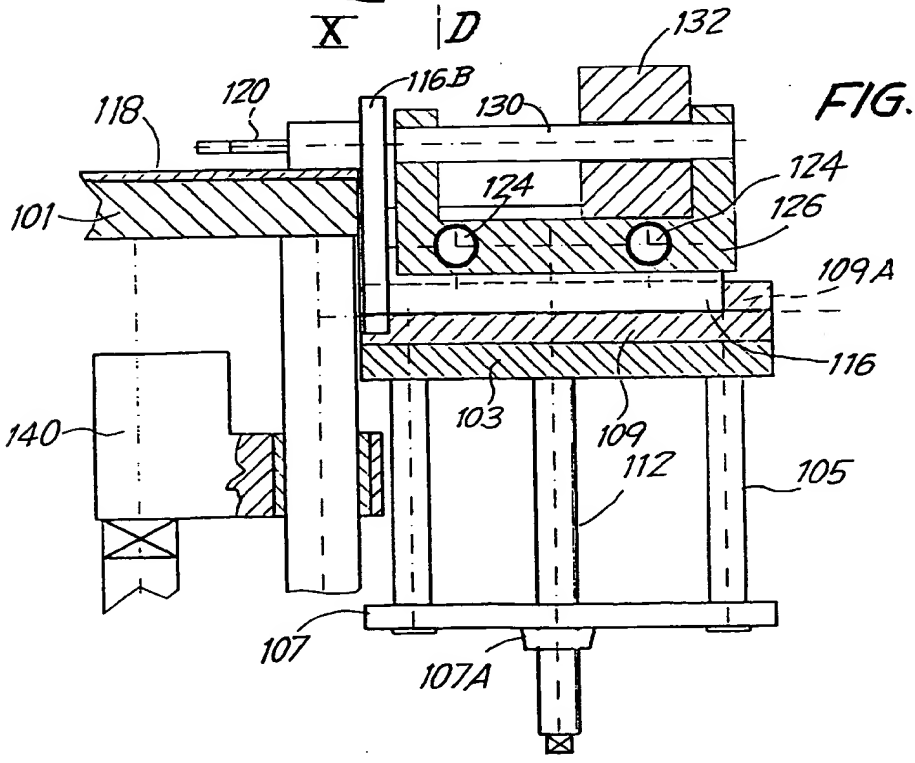

132
116B
120
118
130
124
124
126
101
109A
116
140
103
109
112
105
107
107A

FIG.9

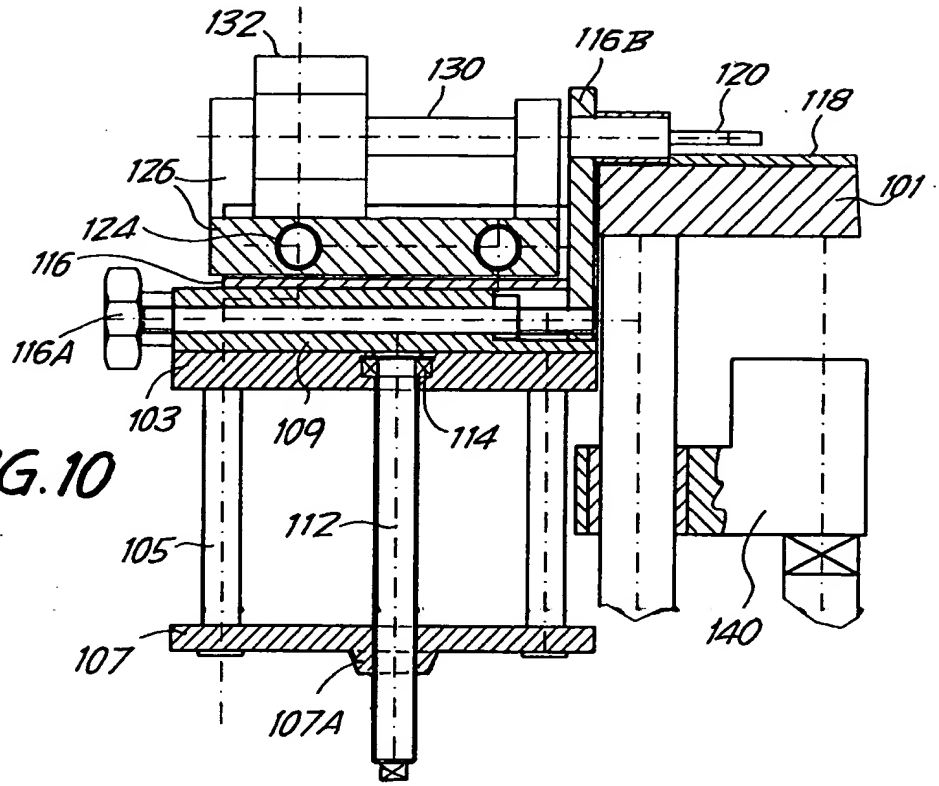

132
130
116B
120
118
126
101
124
116
116A
103
109
114
112
105
107
107A
140

FIG. 10

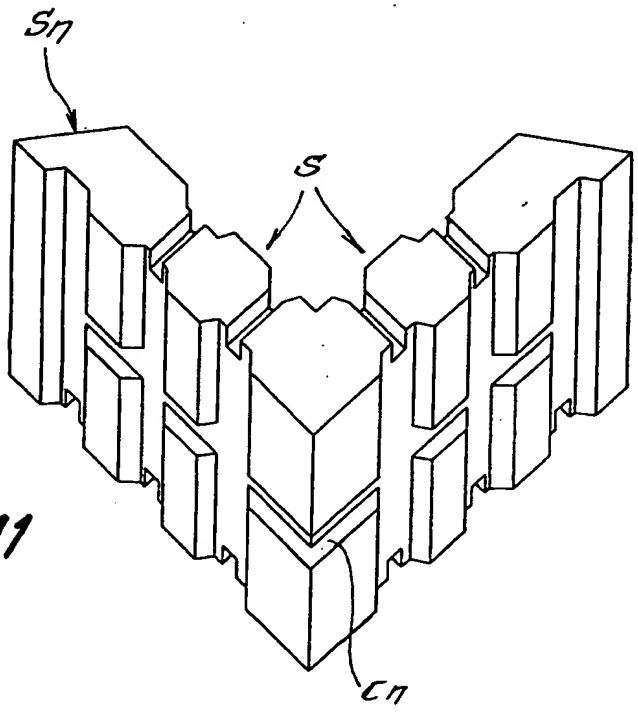

Sn
S
Cn

FIG. 11

The invention relates to the technique for the formation of metal frames, using sections which are usually mitred, converge at the corners, and are connected there by means of brackets housed within the sections. The connection is made by joints using a shape fit provided by the chamfering of the walls - most commonly the external wails - of the sections to provide deformations with perforations if necessary, and to create areas which bear against the shoulders of the bracket. More or less automated equipment exists to execute these joints.

The use of an adhesive to enhance the mechanical connection is also common. The glue is most commonly distributed by hand on the bracket before it is inserted into the sections; the operation is consequently laborious and the effectiveness of the gluing cannot always be relied upon.

The principal object of the invention is to apply a method and to produce equipment for providing a chamfered and glued joint which will be more reliable and more automated than those which are currently available. Other objects and advantages will be made clear by the following text.

A first object of the invention is a method for the formation of metal frames or similar items by the joining of sections converging at a corner by means of an internal bracket which is glued to the sections as well as being fixed to them mechanically.

According to this method, the liquid adhesive is injected between the bracket and the sections after the positioning of the components (and after chamfering if necessary). The injection may advantageously be executed by pressure through a hole made in one section or in each section, or made between the two sections.

A second object of the invention is equipment for the joining of sections converging at a corner with the aid of an internal bracket, for the formation of metal frames and the like, of the type comprising - at a location for the components that are to be assembled - chamfering devices capable of deforming one wall - most commonly an external wall - of each section to bear against a corresponding stop on the bracket. According to the invention, the equipment also comprises at least one drilling device and one device for injecting through the said hole a liquid adhesive capable of securing the fastening between the bracket and the sections.

In practice, the equipment may comprise an element for the drilling and injection devices which is moved between two positions to bring first the drilling device or devices and then the adhesive injection device or devices into the operating position.

The equipment may also comprise means for adjusting the operating position of the devices in accordance with the shape requirements of the components to be secured.

In a possible embodiment, the equipment may comprise a single drilling device and a single injection device, these being placed in the operating position with their axes substantially lying in the plane bisecting the dihedral angle formed by the converging sections and in any case within the external corner formed by the chamfered sections. On the said element, the drilling device and the injection device may be disposed with their axes in a plane substantially corresponding to the plane bisecting the corner of the frame being constructed, the movement taking place along this plane. Alternatively, on the said element, the drilling device and the injection device may be disposed with their axes in a plane substantially orthogonal to the plane bisecting the corner of the frame being constructed, the movement taking place along this plane. In another possible embodiment, the equipment comprises on the said element two drilling devices and two corresponding injection devices, disposed symmetrically about the plane bisecting the frame being constructed and capable of acting on the external sides of the two sections next to the arms of the bracket. A guide system orthogonal to the bisecting plane may be provided on the said element, to move symmetrically in and out two sliding supports, each of which carries a drilling device and an injection device. The said guide system may be carried in turn by a sliding block which is movable on the said element to approach and move away from the location for the components to be assembled.

The invention will be more clearly understood from the description and the attached drawing, which shows practical and non-restrictive examples of the invention. In the drawing,

Fig. 1 is a view and partial section, substantially from the line I-I in Fig. 2 in a substantially frontal direction, of a first embodiment of the equipment;

Fig. 2 is a vertical section through II-II in Fig. 1;

Fig. 3 is a plan view and partial horizontal section through III-III in Fig. 1;

Fig. 4 is another plan view and partial section through the line IV-IV in Fig. 1;

Figs. 5 and 6 are detail sections substantially through lines V-V and VI-VI in Fig. 3;

Figs. 7 and 8 are a plan view and partial section and a section through VIII-VIII in Fig. 7 of a second embodiment of the equipment;

Figs. 9 and 10 are two sections through IX-IX and X-X in Figs. 7 and 8; and

Fig. 11 is a perspective view of a bracket which may advantageously be used with the method and equipment concerned.

According to the illustrations in the attached drawing, Figs. 1 to 6 show a first embodiment in which a pair of chamfering devices of a known type and a pair of devices for injecting an adhesive are provided. In this example, 1 indicates the base structure for the support of the sections P which converge at the corner to be formed and are to be connected by means

of a bracket S. The flat member 1 forms part of a structure which also comprises vertical guides 3 connected below by a horizontal plate 5.

On the structure 1 there are provided two chamfering devices indicated in a general way by 7 and disposed symmetrically about a bisecting plane which coincides with the plane of joining of the mitred surfaces of the two sections B for the formation of the corner of the frame with the aid of the bracket S; 7A indicates the chamfering tools which act on the external surfaces of the sections P to cause their deformation or possibly their perforation in order to ensure the fastening of the bracket S by the bearing of the deformed parts of the sections P against shoulders formed by the bracket S and corresponding to the deformations which form supporting and force-fitting catches and which are produced by the chamfering tools 7A. The positions of these devices 7 may be adjusted, by a method known in these machines, according to the types of bracket which may be used on different occasions by the user. With a known arrangement, a replaceable bracket or fork 9, whose position is adjustable by means of a plate 10 and a support 12 which forms guides for pins 14 which may be inserted in slides which are also formed by the support 12, is provided immediately above the supporting plane formed by the structure 1; 16 indicates a knob for the engagement by screwing of the replaceable bracket or fork assembly 9, 10; the bracket or fork 9 is used to determine the position of the sections P converging at the corner to be formed and engaging with the connecting bracket S to form the frame.

According to the invention and according to the example illustrated in Figs. 1 to 6, a vertically slidable and driven element 20 is mounted on the vertical guides 3 so that it can reach two predetermined positions along the guides 3 by means of a cylinder and piston system 22, the end of whose rod 22A is engaged rotatably at 24 with a vertical adjusting screw 26 whose thread is engaged with a bush 28 which is integral with the said element 20; by adjusting the screw 26 with a spanner, the two positions of the element 20 are adjusted with respect to the guides 3, whose positions are reached by the action of the cylinder and piston system 22, 22A with a fixed spacing between the said two positions; this spacing corresponds to the centre spacing between the drilling device and the injection device in each of the two pairs of devices which are provided on the element 20; by means of the adjustment obtained with the screw 26 and the bush 28 it is possible to adjust the active positions of the two drilling and injection devices which are carried by the said element 20 in the way indicated below, in such a way as to match the two positions to the shape and dimensional characteristics of the sections P of the frame to be formed in any desired way.

The element 20 forms a dovetailed sliding guide 20A which is orientated parallel to the plane bisecting the corner to be formed with the sections P, this bisecting plane corresponding to the plane of the section II-II in Fig. 1 and to the plane A-A indicated also in Fig. 3. A sliding block 30, which can slide along the guides 20A and consequently in the said bisecting plane and whose position may be adjusted by means of a screw knob 32, is fitted on the guides 20A of the element 20. The sliding block 30 has an elongated slot which permits the passage of the adjusting screw 26 for the vertical adjustment of the element 20 and the displacement of the sliding block 30 in the said bisecting plane passing through A-A.

In turn, the sliding block 30 has dovetailed guides 38 which are orthogonal to the bisecting plane passing through A-A and which are disposed symmetrically about the said plane and aligned with each other. A support 40 is slidable on each of the said guides 38 and its position may be adjusted; the two supports 40 are inclined symmetrically about the plane passing through A-A so that they may be orientated in directions converging on the fork 9, the sections P to be joined and the bracket S for connecting the said sections. A double-threaded rod 42 is engaged in corresponding threaded holes in the two supports 40; the said rod 42, whose axis is orthogonal to the plane passing through A-A and therefore parallel to the direction of the two guides 38, is engaged rotatably but with axial restraint with a lug 44 carried by the sliding block 30. By means of a knurled disc 46 integral with the double-threaded rod 42, it is possible to manoeuvre the said rod and thereby adjust the positions of the two supports 40 symmetrically along the guides 38, in such a way as to keep the supports symmetrical about the bisecting plane passing through A-A.

Each of the supports 40, which may be adjusted along the corresponding guides 38, has two vertical plates 40A which in their lower parts form sliding housings for an injection cartridge 50 intended by means of its nozzle 50a to supply at the correct time a specified quantity of adhesive for the purposes stated below. The plates 40A also form sliding housings for a tool 52 with a drill bit 52A and with a pneumatic motor 52B for the rotation of the said bit 52A. In each support 40, 40A the devices 50 and 52 are carried by a vertical plate 54 which is slidably supported and guided by cylindrical guides 40C which extend between the two plates 40A and are parallel to the axes of the device 52 and of the cartridge 50. The plate 54 and consequently the device 52 and the cartridge 50 are movable along the guides 40C by means of a threaded rod 58 engaged in a bush of the plate 54 and caused to rotate by a step-by-step motor 60 carried by one of the plates 40A. By means of the activation of the motor 60, therefore, it is possible to advance and withdraw both the bit 52A of the drilling device 52

and the nozzle 50A of the adhesive injection cartridge 50, in an adjustable way and in particular with adjustable speed, to predetermined positions which are also adjustable. This disposition is provided in each of the two symmetrical supports 40, 40A which are adjustable to advance and withdraw, while remaining constantly parallel to themselves, by means of the threaded rod 42 which drives them simultaneously and symmetrically. The devices 50, 52 of the two said pairs are then adjustable in the direction of the bisecting plane passing through A-A by means of the movement of the sliding block 30 and are movable to two alternative positions in the vertical direction by the cylinder and piston system 22, the two positions being the operating positions of the drill bit 52A (of the device 52) and of the nozzle 50A (of the injection cartridge 50) respectively. These operating positions are adjustable by means of the adjusting screw 26 which changes the relative position of the end of the rod 22A of the cylinder and piston system 22, 22A with respect to the element 20 in which the screw 26 is engaged. With this disposition, therefore, it is possible to move the two assemblies 52, 52A and 50, 50A into the operating positions alternately; to advance or withdraw the working ends of the components 52A and 50A with respect to the sections P and to the bracket S carried by the flat member 1 of the fixed structure and positioned by the bracket or fork 9; and to provide an adjustment of the relative positions of the two supports 40, 40A carrying the two pairs of devices, in accordance with the position in which the drilling by the bits 52A and the injection of adhesive by the cartridges 50, 50A are to be executed. All this may be done independently of the adjustment which may be made (in a known way) for the tools 7A used to clamfer a nd consequently to deform the sections P for the mechanical joining with the bracket S.

The operating positions of the drills and of the injectors are preferably displaced from the positions of the chamfering tools. By withdrawing the tools 7A, it is possible to use the drills and injectors even at points not remote from the chamfering areas.

With this equipment, a hole is made with the corresponding bit 5A of the device 52, and adhesive is then injected by means of the nozzle 50A of the corresponding cartridge 50, at a predetermined position along each of the two converging sections P, after the whole element 20 has been raised by the cylinder and piston 22 from the lowered position, corresponding to the position of drilling with the bits 52A, to the raised position corresponding to the injection of the adhesive by means of the nozzle 50A into the corresponding hole formed by the appropriate bit 52A. The advance and withdrawal of the bit 52A and the nozzle 50A are executed by the motor 60 which is a step-by-step motor to establish the exact position of deceleration and subsequently of halting of the advance for drilling and for injection respectively, while the drill bit 52A is driven by its own motor 52B which for example may be a pneumatic motor activated at the correct time. The nozzle 50A is activated by an appropriate actuator which for example may be pneumatic, with a suitable program.

It is thus possible to execute - preferably before, but possibly after, the chamfering with the tools 7A and therefore before or after the mechanical joining - the drilling of the external walls of the two sections P converging at the corner to be formed, and then to execute an injection of the adhesive with the cartridges 50, so as to fill with the adhesive the interstices between the sections P and the bracket S and thus to fasten these three components as a result of the setting of the adhesive.

The brackets used may be those of a type already known and used generally for this type of injection with the adhesive distributed in the interstices, but it is also possible to use brackets suitably prepared for this application, such as that shown in Fig. 11, which is also designed particularly for use with the equipment shown in Figs. 7 to 10, which will now be described.

According to the illustrations in Figs. 7 to 10, the equipment has a single pair of devices for drilling and for injecting the adhesive. In this embodiment, 101 indicates a flat base member with a box-shaped part 103 through whose lower part pass guide columns 105 connected by a frame 107 at the bottom and by a plate 109 at the top. The assembly 109, 105, 107 forms an element which is vertically adjustable by means of a threaded rod 112 which is rotatably engaged at 114 with the bottom of the box 103 and is engaged by screwing at 107A with the frame 107 of the element 109, 105, 107; in this way, the element comprising the plate 109 is adjusted vertically by turning the threaded rod 112. The plate 109 forms a dovetailed guide 109A for a sliding block 116 which may therefore be made to slide horizontally in a direction towards and away from the flat member 118 supporting the sections to be joined; the flat member 118 (combined with the base member 101) is immediately below the centring fork 120 of the dihedral angle formed by the converging sections; in the disposition in Figs. 7 to 10, the fork 120 is placed with a central aperture 120A (Fig. 7) next to the plane bisecting the dihedral angle formed by the two sections. The sliding block 116 carries two guides 124 which are horizontal and orthogonal to the guide 109A, for a slide 126 which forms the support of the two devices; for this purpose, the slide 126 forms two guides 130, substantially parallel to the direction of the dovetailed guide 109A, for the two devices, in particular for the device 134 with the drill bit 134A and the motor 134B for the rotation of the slide, and the device 136 for injecting the adhesive through the nozzle 136A. The body 132 is caused to slide with respect to the slide 126 on the guides 130 by a motor which may be a

step-by-step motor and which operates between the slide 126 and the body 132 to move the body 132 and the devices 134, 136 with respect to the slide. With a screw knob 116A engaged in the plate 109 it is possible to adjust the position of the sliding block 116 which with its part 116B supports the fork 120, in such a way as to adjust the position of the fork in accordance with the shape of the sections which are to be joined and which converge at the corner. The assembly supported ultimately by the body 132 follows these adjustments, and the body 132 may be moved either along the transverse guides 124 or longitudinally on the guides 130. The transverse movements on the guides 124 enable the drill bit 134A of the device 134, in the first place, and the nozzle 136A of the device 136 for the injection of the adhesive, in the second place, to be brought alternately next to the aperture 120A in the fork 120. These movements for the successive stages of drilling and injection are executed in a direction orthogonal to the bisecting place passing through D-D and coinciding with the plane of the section X-X.

In this case, the drilling is executed at the external angle formed by the two joined mitred sections and the injection takes place into this single hole to distribute the adhesive in the interstices between the sections and bracket from a single source, rather than from two sources as in the solution shown in Figs. 1 to 6. In this embodiment shown in Figs. 7 to 10, the movement of the pair of tools 134, 136 is executed in a plane orthogonal to that in which the pairs of devices in the previous example are moved. However, there is no reason why, in a disposition similar to that in Figs. 1 to 6, the pairs of devices such as 134 and 136 should not be moved in the bisecting plane rather than orthogonally to the bisecting plane; the solution illustrated is preferable for reasons of size. In the solution in Figs. 7 to 10 also, it is possible to adjust the height of the drilling position and the adhesive injection position with respect to the pair of sections and to the bracket used, the advance and return movement of the working parts 134A and 136A of the devices 134 and 136 is possible, and transverse movement may also be executed to position each of the devices in turn transversely in the area of the bisecting plane (or along the bisecting plane).

140 indicates a part of the equipment which is used to drive the chamfering tools 142A and chamfering devices 142.

Fig. 11 illustrates a bracket SN of a new type covered by another patent held by the holder of the present patent; this is particularly suitable for use with the equipment in Figs. 7 to 10, since it has an injection cavity CN which is transverse with respect to the dihedral angle formed by the bracket itself, next to which injection cavity it is possible to drill the sections in the joining area and to inject the adhesive with devices 134 and 136 respectively. The injection cavity CN is combined with depressions, channels and passages for the distribution of the adhesive.

It is to be understood that the drawing shows only an example provided solely as a practical demonstration of the invention, this invention being variable in its forms and dispositions without departing from the guiding principle of the invention.

Claims

1. Method for the forming of metal frames or similar by the joining of sections converging at a corner by means of an internal bracket which is glued to the sections as well as being fastened to them mechanically, characterised in that the liquid adhesive is injected between the bracket and the sections after the positioning of the components.

2. Method according to the preceding claim, characterised in that the injection is executed under pressure through a hole made in one section or in each section, or made between the two sections, and may be executed with automatic programming.

3. Equipment for the joining of sections converging at a corner with the aid of an internal bracket, for the formation of metal frames and the like, comprising - at a seat for the components that are to be fastened - chamfering devices capable of deforming one wall - most commonly an external wall - of each section to bear against a corresponding stop on the bracket, characterised in that it also comprises at least one drilling device (52, 52A; 134, 134A) and one device (50, 50A; 136, 136A) for injecting a liquid adhesive capable of securing the fastening between the bracket and the sections.

4. Equipment according to Claim 3, characterised in that it comprises an element (20, 30, 40; 132, 126) for the drilling and injection devices which is moved between two positions to bring first the drilling device or devices (52, 52A; 134, 134A) and then the adhesive injection device or devices (50, 50A; 136, 136A) into the operating position.

5. Equipment according to Claim 4, characterised in that it comprises means for adjusting the operating position of the devices in accordance with the shape requirements of the components to be secured.

6. Equipment according to Claim 3 or 4 or 5, characterised in that it comprises a single drilling device (134, 134A) and a single injection device (136, 136A), which are positioned in the operat-

ing position with their axes substantially lying in the plane bisecting the dihedral angle formed by the converging sections and in any case within the external corner formed by the mitred sections.

7. Equipment according to Claim 6, characterised in that it comprises, on the said element, the drilling device and the injection device, disposed with their axes in a plane substantially corresponding to the plane bisecting the corner of the frame being constructed, the movement taking place in this plane.

8. Equipment according to Claim 6, characterised in that it comprises, on the said element (132, 126), the drilling device (134) and the injection device (136), disposed with their axes in a plane substantially orthogonal to the plane bisecting the corner of the frame being constructed, the movement taking place in this plane.

9. Equipment according to at least one of Claims 1 to 5, characterised in that it comprises on the said element (20) two drilling devices (52, 52A) and two corresponding injection devices (50, 50A), disposed symmetrically about the plane bisecting the frame being constructed and capable of acting on the external sides of the two sections (P) next to the arms of the bracket (S).

10. Equipment according to Claim 9, characterised in that there is provided on the said element (20, 30) a system of guides (38) orthogonal to the bisecting plane to move symmetrically in and out two sliding supports (40, 40A), each of which carries a drilling device (52, 52A) and an injection device (50, 50A).

11. Equipment according to Claim 10, characterised in that the said system of guides (38) is carried in turn by a sliding block (30) which is movable on the said element (20) to approach and move away from the location for the components to be assembled.